Claims

1. A method of performing model-based optical proximity correction comprising:
   calculating a finite integral for each sector of a mask polygon having defined corners to determine sector contributions from vertices of said mask polygon;
   integrating on a finite shape in said sector;
   summing up the contribution of said sectors of said mask polygon; and
   calculating interaction effects from said finite integral calculation.

2. The method of claim 1 wherein said finite shape comprises at least two triangles.

3. The method of claim 1 including integrating in each of said corners of said polygon.

4. The method of claim 2 including using a triangle convolution on unbounded sectors.

5. The method of claim 2 including using a triangle convolution on a power-law incoherent kernel.

6. The method of claim 5 comprising reducing said triangle convolution to an analytic expression that contains an incomplete beta function to facilitate numerical integration.

7. The method of claim 6 further comprising determining a minimum radius, R_{min}, such that said convolution does not double count any contribution from inside a ROI.

8. The method of claim 7 including providing a rule for a positive or negative sign of said contributions, comprising:
   assigning said sign of a first triangle to +1 for two partitions on a side of a first edge that are inside a sector and for said partition opposites, otherwise assigning said sign of said first triangle to –1 ;

assigning said sign of a second triangle to said sign of said first triangle if said first and second triangle does not overlap, otherwise assigning said sign of said second triangle to the opposite of said sign of said first triangle.

9. The method of claim 7 including analytically defining a hole in a flare kernel having said radius R_{min} and treating any contributions from said flare that are within R_{min} with a partial coherent bilinear convolution.

10. The method of claim 9 further including having said radius R_{min} approximately equal to λ/NA.

11. The method of claim 1 wherein said step of calculating said interaction effects includes integrating over a coarse grid of a plurality of mask polygons.

12. A method of extending lithographic simulation integrals to include intermediate-range and long-range distance scales, said method comprising:

dividing and decomposing at least two mask polygons into sectors made up of triangles having corners and edges;

performing a distance scale calculation from corners of a plurality of said at least two mask polygons;

implementing a polygon pinning algorithm;

performing a triangle convolution of said plurality of mask polygons;

combining contributions of said sectors to yield a convolution of said plurality of said mask polygons;

combining said plurality of said mask polygons; and

computing an aerial image for optical proximity correction from said combined sector contributions.

13. The method of claim 12 wherein said step of performing a distance scale calculation includes performing finite integrals from semi-infinite corners of said mask polygon.

14. The method of claim 12 further comprising:

calculating contributions from said each of said polygons at an image sample point;

converting area convolution into a position vector dependent integral around a feature perimeter using first and second position vectors;

assigning a resultant indefinite integral for said edges, such that a contribution from an edge between vertices of said first and second position vectors is a difference of indefinite integrals evaluated at each position vector; and

parameterizing said resultant indefinite integral as function of an orientation of said edge, a perpendicular distance from said position vector to said edge, and a polar angle defined from said first position vector to said second position vector.

15. The method of claim 14 including providing a rule for a positive or negative sign of said contributions.

16. The method of claim 15 wherein said rule is adapted for said sectors including six basic sectors comprising 45-degree and 90-degree sectors.

17. The method of claim 15 including storing values of said convolution in a first look-up table for various values of said position vectors.

18. The method of claim 15 wherein said rule comprises:

assigning said sign of a first triangle to +1 for two partitions on a side of a first edge that are inside a sector and for said partition opposites, otherwise assigning said sign of said first triangle to –1;

assigning said sign of a second triangle to said sign of said first triangle if said first and second triangle does not overlap, otherwise assigning said sign of said second triangle to the opposite of said sign of said first triangle.

19. The method of claim 18 including storing said signs of said triangle convolutions within a second look-up table, said second table having a row index and a column index,

such that said row index is assigned for said first edge of said sector and said column index assigned for a second edge direction, uniquely specifying said sector type, said row and column indices determined for any sector in consideration, based on said first and second edge directions.

20. The method of claim 19 including having first and second sign matrices, Mat1(edge1,edge2) and Mat2(edge1,edge2), for said second look-up table, said matrices expressed as a function of said first and second edges, such that said first sign matrix, Mat1(edge1,edge2), determines which of said partitions where said direction vector may lie will have a positive sign for said first triangle, and said second matrix, Mat2(edge1,edge2), determines which of said partitions where said direction vector may lie gives the same sign for said second triangle compared to said first triangle.

21. The method of claim 20 wherein said row and column index of each matrix are given by eight basic partitions comprising: up, down, right, left, up-right, up-left, down-right, and down-left.

22. The method of claim 21 further comprising multiplying said sign by –1 if said sector is convex, or by +1 if said sector is concave.

23. The method of claim 20 wherein said first matrix signifies which subsets of said partitions carry a positive sign or negative sign, such that if said partition matches a matrix entry, said sign of said first triangle convolution is assigned a positive value.

24. The method of claim 23 including having said sign of the second triangle convolution equal to said sign of said first triangle partition within which said direction vector resided, else said sign is opposite said first triangle convolution sign.

25. The method of claim 24 further including adding a constant of integration in an indefinite integral for each edge, such that said constant of integration is independent of

said polar angle, said constant of integration allowing for removal of any infinities in contributions from vertices in isolation.

26. The method of claim 25 further comprising having said constant of integration present only in said indefinite integral, vanishing when a difference is taken of said indefinite integral at two endpoints of said edge.

27. The method of claim 25 wherein a contribution from an individual mask polygon that has a plurality of edges is represented by a summation over each edge of said mask polygon such that for each corner of said edge said constant of integration is subtracted from said indefinite integral.

28. The method of claim 25 further comprising resolving singularities that arise from unbounded individual corners by adding constant of integration terms that leave corner contributions finite, such that each corner contribution is a summed flare from a pair of said triangles of said triangle convolution.

29. The method of claim 28 wherein said corner contribution comprises a calculation of a contribution from two of said triangles per vertex, such that said contributions from said triangle convolution gives a net contribution of said mask polygon after summation through all vertices.

30. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for performing model-based optical proximity correction, said method steps comprising:

calculating a finite integral for each sector of a mask polygon having defined corners to determine sector contributions from vertices of said mask polygon;

integrating on a finite shape in said sector;

summing up the contribution of said sectors of said mask polygon; and

calculating interaction effects from said finite integral calculation.